

Amateur Radio Operations On Board the International Space Station

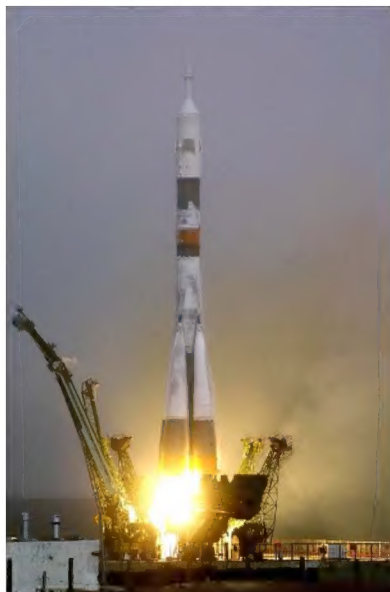
Will Marchant, KC6ROL

Frank Bauer, KA3HDO

Synopsis:

In 1996, the SAREX team proposed to the ISS management that amateur radio become a permanent feature of the ISS. Because of the success of ham radio on the Shuttle and Mir, this proposal was met with great support. Because of the international nature of the ISS, a multi-national amateur radio group called ARISS, for Amateur Radio on board the International Space Station, was formed to implement ham radio on the ISS. Amateur radio equipment was carried to the ISS on board the STS-106 mission and ham radio activity was inaugurated by the Expedition One crew in late 2000. Support for ham radio on board the ISS remains strong with numerous school contacts, frequent general voice QSOs, and packet activity. This paper will summarize ham radio operation activities by the Expedition One and Expedition Two crews. As this paper is being written the changeover between Expedition Two and Expedition Three is occurring. Expedition Three activities will be summarized in a future paper.

Expedition One: School contacts, General contacts, Packet Contacts.



Expedition One was launched to the ISS on board a Soyuz rocket in October of 2001.

ISS commander Bill “Shep” Shepherd, KD5GSL, was the expedition commander. Yuri Gidzenko was the Soyuz commander. Sergei Krikalev, U5MIR, was the flight engineer.



Ham radio activity on the ISS started on 2000-11-13 at 06:17 UTC with a successful engineering test conducted with the R3K station. Later that day test passes were accomplished with NN1SS and W5RRR as well as several more R3K contacts. These all demonstrated the excellent signal quality from the ISS. Shep repeatedly said that the amateur radio system provided the best quality air-to-ground voice link on the ISS. The crew built up familiarity with, and enthusiasm for, ham radio with QSOs with family and close personal friends over the next several weeks.



Sergei, U5MIR with the ham rig.

School contacts started in mid-December. The crew had radioed down "we want to keep you busy [with school contacts]" but we could never get clarification about what that meant. We are working with the crew surgeon's office to establish the crew's wishes before they fly. We interpreted it to mean a school contact spaced at approximate week intervals.

We accomplished seven school contacts. Three of those were "crew picked" schools and the others were schools left over from the Shuttle and Mir, some from the mid-90s. Gaps due to shuttle missions to ISS and

allowing the Exp1 crew time to "settle in" were the biggest reason for the limited number of school contacts.

Date	School	Teacher	Mentor	Uplink
19Dec00	Burbank School, Burbank, IL, USA	Rita L. Wright	AJ9N	AJ9N
05Jan01	Armstrong Fundamental School, Hampton, VA, USA	Denise W. Corson	AA8HH	KE4ZXW
18Jan01	Sheldon Elementary School, Varysburg, NY, USA	Karen Washburn	WA3GOV	WA2CAM
30Jan01	George West School, George West, TX	Keith Rogers	N6IZW	K5YFL
22Feb01	Merivale Public School, Ottawa, Ontario, Canada	Lori McFarlane	VE3PU, AJ9N	VE3TBD
01Mar01	Polynesian Voyaging Society	Bernie Kilonsky	KC6ROL	AH6NM
07Mar01	Arcadia High School	Cynthia Foss	AJ9N	KD7LAC

Several factors have had significant impacts to the school program: lack of good orbital predictions for ISS and getting final confirmation of the school contact time only a few days before the event. Unfortunately, both of these are endemic to the ISS program as a whole. It is not clear that there is a good answer for either problem. The ISS schedulers made heroic efforts on a number of occasions to fit school contacts into the schedule: they are to be commended. The schools certainly appreciated their efforts!

General contacts were almost non-existent. This primarily seems to have been a function of the extremely heavy workload for Expedition 1. A secondary issue was the relative "remoteness" of the ham gear at the temporary location in the FGB. The crew commented in the post-flight debrief that somewhere near the table in the Service module would be much more convenient. Of course, this is the location to be used once the external antennas fly later. Another complaint was a lack of a computer running the WorldMap tracking software near the ham rig. Ham radio from space is primarily a function of what part of the world you are flying over. Since there are no windows in the FGB and there is no WorldMap available, crew using the ham rig are in a state of "sensory deprivation." The large number of family contacts on the ham gear combined with the lack of general contacts produced a large amount of negative publicity. There needs to be a balance of the three goals of ham radio in space: school, family, and public ham radio contacts. (The work schedule for expedition two is producing a much more balanced use of the ham equipment.)

Packet contacts were non-existent during expedition one. Apparently the packet module was functioning early in the mission as a number of packets were heard during voice operations. It now appears that the battery maintaining the internal settings may have discharged, which would account for the lack of automatically transmitted "beacons" later during Exp1. But attempts to connect to the packet module from the ground failed. Once again, it was very difficult to get verification that the ham radio equipment was in a configuration that would support diagnosis from the ground. A procedure was developed and sent up to the crew to diagnose and correct the purported battery problem. Due to workload the crew never accomplished that procedure. The biggest issue was the lack of a laptop computer for use with the packet module. A dedicated laptop was not flown for the ham rig because the team was told a laptop would be available. This unit has never materialized. (Several weeks into Exp2 the packet function spontaneously started to work. The mode it is in seems to confirm the "dead battery" hypothesis.)

Expedition Two: School contacts, General contacts, Packet Contacts.



Expedition two is commanded by Yuri Gidzenko, with James Voss, and Susan Helms, KC7NHZ, making up his crew.

The Expedition Two crew accomplished fourteen school events. This increase from Expedition One reflects the slightly relaxed pace of ISS buildup. Expedition One had solved many of the critical teething problems of the ISS. While Expedition Two remained very busy, it was easier to fit highly desirable, but nonessential, activities such as school contacts into their schedule.

Date	School	Teacher	Mentor	Uplink
26Mar01	John B. Reible School, Santa Rosa, CA, USA	Kristie Weber	W6ISS	W6ISS
09Apr01	Woodford County Middle School, Versailles, KY, USA	Leslie S. Curtis	AA8HH	VK5ZAI
11Apr01	Vicksburg High School, Vicksburg, MS, USA	Michael Brantley	W5UE W8JE	AH6NM
16Apr01	Admiral Moorer Middle School, Eufaula, AL, USA	Brenda O'Neal	W8JE	NN1SS
17May01	Parkway Central High School, Chesterfield, MO, USA	Mary Jo Kohunsky	WA3GOV	KC0PCH
23May01	Moran Prairie Elementary School, Spokane, WA, USA	Theresa Darke	N6IZW	W7TRF
31May01	Daviess County High School, Owensboro, KY, USA	Harold Wilson	AA8HH	AH6NM
12June01	Henley Middle School, Klamath Falls, OR, USA	Walter R. Jones, Jr.	W6ISS	VK5ZAI
21Jun01	Boulder County Schools- Alpha Project	Christine Labozan	K5YFL	K0RZ
27Jun01	New Mexico Museum of Natural History	Jayne Aubele	K5YFL	KK5YY
04Jul01	Saint Petersburg Junior Technical Center, St. Petersburg, Russia	Boris UA1AAF	KC6ROL	RZ1AWO
12Jul01	Peebles Elementary School, Buzzards Bay, MA, USA	Jan Butler	K5YFL	W6SRJ
25Jul01	Boy Scout Jamboree, Fort A. P. Hill, VA, USA	John Cross	K5YFL	K2BSA
31Jul01	Joan Martin Elementary, Hobart, IN, USA	Suzanne Furgye	AJ9N	KF9WW

Susan Helms was performing random voice QSOs on the ISS ham radio rig within days. Susan's voice has become a familiar sound on many weekends. Susan was also quite active for the 2001 Field Day event. She logged over 250 callsigns and submitted 202 unique callsigns for Field Day points. Susan's score was 1010 regular points with 300 bonus points.

On 08Apr01 KA3HDO announced that the packet TNC on the ISS had been activated and was on frequency for general use. The packet rig was not automatically beaconing, and was only responding to the "NOCALL" callsign, the factory default built into the ROM. After a lot of investigation, the ARISS team determined that the backup batteries that maintained the programmed settings in RAM had discharged. A new TNC has been sent to the ISS with a good backup battery and factory defaults changed in ROM to be appropriate for the ARISS mission. This was not an option for the first TNC because callsigns were not known in time for the hardware to be ready for flight. The new TNC is scheduled to be installed by Expedition Three and will respond as RS0ISS.

Tourists in space

Many readers will be aware of the flight of American Dennis Tito to the International Space Station. Mr. Tito is listed as the first tourist to pay his own way into outer space. Mr. Tito's representatives contacted the ARISS team and requested that the amateur radio hardware be made available for his use during the visit to the space station. Because of the unusual nature of Mr. Tito's visit to the ISS, the ARISS team contacted ISS management to discuss the options for allowing Mr. Tito to use the ISS ham shack. ISS management was very professional and granted approval, so long as the use was on a "non interference" basis. These were the same terms that were imposed on all Mr. Tito's activities on board the ISS. Because of the short length of his flight, the ARISS team arranged for one contact every day for the duration of his mission. The ARISS telebridge network was used to support these activities. Dennis professed himself very happy with his stay on orbit and was ecstatic in his praise of amateur radio on board the ISS.

Conclusion

The first year of amateur radio operations on board the ISS has seen the realization of years of hard work and dreams. Regular school contacts, frequent random voice QSOs, and an active packet system make all the work worthwhile.

Expedition Three has expressed strong support for school contacts via amateur radio. We will have to see if they are as enthusiastic for random voice QSOs as Susan Helms. Packet will continue to be almost constantly available. Packet has proven that a modest terrestrial packet station has a chance to work the ISS.

Many astronauts are taking time from their very full schedules to get licensed. Interest by future ISS crews increases. An active training and mentoring effort by the JSC Amateur Radio Club, W5RRR, will ensure that future crews are excited about amateur radio.

The amateur community can look forward to many years of direct participation in the world's human spaceflight program through the ARISS project on board the ISS.